Exhibit D - Factor 2 Need

State of Missouri

04MissouriExDFactor2Need.pdf

EXHIBIT D - FACTOR 2 NEED

Most Impacted and Distressed: Risks and Vulnerabilities Related to Severe Weather

The North St. Louis County target area is inhabited by a disproportionately large population of low- and moderate-income families, low educational attainment rates, and suffers a high unemployment rate. In addition, residents face three key threats - river flooding, heat waves and severe storms that include high winds, hail, flash flooding, and tornadoes. In addition, the target area has proximity to the New Madrid Seismic Zone and the St. Genevieve Seismic Zone.

The potential for significant damage could be characterized as a perfect storm due to the following: a dense urbanized area with little permeable surface; an aging and largely low-quality housing stock primarily located in or near a floodplain; and, over 100,000 residents living below the federal poverty level in a concentration of economically-distressed neighborhoods.

Research findings cited in the National Climate Assessment on the increasing threat of severe weather and natural disasters, combined with local data on the socioeconomic circumstances and the condition of the built environment in North St. Louis County before, during, and after the two tornado events of 2011 and 2013 point to a vulnerability and unpreparedness in the population *Exhibit B (see page ExB-4, Most Distressed).* Four years after the first set of tornadoes, dozens of houses remain vacant and boarded due to a lack of insurance and resources to make repairs. Many small businesses remain closed. Jobs have disappeared and people have been forced to find work elsewhere. The loss in tree canopy that provided energy savings and carbon sequestration was not replaced, leaving North St. Louis County more vulnerable to heat island effects and heat waves.

The data demonstrates pre-existing stress in the health and well-being of the population and soundness of the built environment that is worse today than prior to the two tornado events.

These facts will hinder the community from bouncing back after the inevitable next disaster. This lack of built-in resilience could lead to even deeper and broader economic hardship, permanent loss of property, and loss of life. The degree to which any one business, household or community (independent variable) is impacted has everything to do with the interdependent resilience of the group of businesses, the county, and the region (dependent variable). *(Ref: MOAttE12TargetAreaInsured.pdf; Attachment A, MOAttAPartnerDocumentation.pdf, pp.8-11)*

Risks from Tornadoes

St. Louis County has a long history of tornadoes, wind, and hail resulting from severe storm weather (*Ref: MOAttE07TornadoHistory.pdf*). According to the U.S. National Weather Service, the two most destructive tornadoes in the United States since 1890, adjusted to the value of property lost and personal wealth, occurred in the St. Louis area. In the last 65 years, 35 tornadoes have carved their way through St. Louis County. Twelve of these were rated an EF3 or EF4 on the Enhanced Fujita (EF) Scale by the National Weather Service. The northern third of St. Louis County seems to be a particular magnet for tornadoes; one-third of the tornadoes that occurred in the county in the last 65 years have crossed through north St. Louis County, roughly north of I-70; seven of those have been rated EF3 or EF4, according to the National Climatic Data Center.

On Friday, April 22, 2011, two tornado super cells crossed the St. Louis area, causing five confirmed tornadoes. One of these, a long-track tornado rated an EF4 based on the damage sustained, sliced a path one-half mile wide across North St. Louis County (*Source: NOAA).* In addition to extensive private property damage and tree canopy loss, the event destroyed an entire concourse, many large windows, and a portion of the roof at Lambert-St. Louis International Airport.

Before reconstruction from the storm events of 2011 was complete, on May 31, 2013, a mile-wide EF3 tornado cut a path through North St. Louis County, again damaging more than 100 homes and tearing through several of the same neighborhoods that were impacted by the 2011 tornadoes. These two tornado events were the strongest that occurred in the area since 1967, a tornado that killed three and injured 216 people. Less than 10 years before that, in 1959, an EF4 tornado touched down, killing 21 people and injuring another 345 (*Ref: MOAttE07TornadoHistory.pdf*).

These two presidentially-declared disasters qualify St. Louis County, Missouri, for this National Disaster Resilience Competition based on the damage and destruction sustained to the cities of Berkeley and Ferguson, Missouri, as well as the census tract that encompasses Lambert-St. Louis International Airport and its immediately surrounding area as shown in *Exhibit B (see page ExB-2, Eligible Declared County)*.

Risks from Floods

The target area is rich with rivers and streams, and water is an integral part of life in North St. Louis County. This also means that the area has historically been prone to flooding. Since 1996, when the National Climatic Data Center began collecting data on floods and flash floods, 53 events have occurred in St. Louis County. This is an average of three floods or flash floods per year. The target area in North St. Louis County includes both the Missouri and Mississippi rivers, the two largest rivers in the United States in both flow volume and length, as well as several tributaries to these, such as Coldwater Creek, Maline Creek, and Watkins Creek, which weave their way through urban and suburban neighborhoods. Of the 53 flood- and flash flood events, almost half have affected the target area in North St. Louis County. Floods have become such a common occurrence in St. Louis County that the dangers of living in a floodplain

without flood insurance are by now well known. Yet many people continue to live there for lack of resources to relocate elsewhere (*Ref: MOAttE13FloodHazards.pdf*). The State conducted property buyouts inside the target area with the most recent project following 2008 flood events.

One tributary of the Missouri River, Coldwater Creek, is contaminated with the radioactive byproducts of uranium extraction, which occurred during the 1940s and 1950s by Mallinckrodt Chemical Plant. The byproduct storage site is part of the Department of Energy's Formerly Utilized Sites Remedial Action Program and is continually undergoing remediation by the U.S. Army Corps of Engineers. However, the creek floods streets and basements regularly during heavy rainfall and the incidence of a cancer cluster has been identified and is now under investigation by the St. Louis County Health Department. As of January 2013, a total of 750 possible linked cases of cancer, lupus, and auto-immune disorders in the nine zip codes of North St. Louis County were identified based on a resident survey conducted by an 8,400-member activist group focused on Coldwater Creek *(Source: St. Louis Magazine, May 22, 2013).* This combination of contamination and flooding introduces another stress on the health and well being of residents and the integrity of neighborhoods in the target area that challenge resiliency in the face of crisis.

The Threat of Severe Weather – Projections from the National Climate Assessment

Though research has not yet been able to establish a distinct correlation between the frequency and intensity of tornadoes, hail, damaging thunderstorm winds, and climate change. A recent study using the Coupled Model Intercomparison Project, Phase 5 climate change model found an increase in atmospheric conditions related to climate change that cause severe weather and tornadoes *(Source: Proceedings of the National Academy of Sciences 110 (41), Diffenbaugh et al., 110 (41), pp. 16361-16366, 2013).*

Research indicates that the St. Louis region will continue to experience an increase in heavy precipitation events and heat waves. A warming atmosphere holds more moisture, resulting in less frequent but more severe, intense downpours. Modeled projections of increasing emissions yield a multiplier of three for increased frequency of extreme precipitation events in North St. Louis County. Indeed, St. Louis County has seen an increase of 10-15 percent over the past 22 years in average annual precipitation compared to the period from 1901-1960. *(Source: National Climate Assessment, p.32).* Extreme precipitation events are expected to double even when emissions are reduced. St. Louis County has seen a six percent increase per decade in flooding. This trend is projected to continue as warming continues.

In addition to heavier downpours, more frequent and intense heat waves are expected, and also will lead to more drought. Over the past 22 years, St. Louis County has experienced a 1-1.5 degree Fahrenheit increase compared to the period from 1901-1960, and is expected to increase to 2-4 degrees Fahrenheit in the next few decades, according to the 2014 U.S. National Climate Assessment. Two of the hottest days on record in St. Louis County occurred in the summer of 2012, between the two tornado events. That year saw 73 days of temperatures of 90 degrees Fahrenheit or higher. *(Source: National Climate Assessment, p.32).* As expected, a spike in heat-related deaths occurred. In 2012, the Missouri Department of Health and Senior Services reported that 12 percent of the total state heat-related deaths occurred in St. Louis County.

Unmet Needs Related to Disaster Resiliency in North St. Louis County

The vulnerabilities to full recovery and resilience against future disasters in the target area of North St. Louis County include: a historical predisposition to tornado paths; a predominance of brownfields located near neighborhoods, streams, and floodplains; a predominantly low-quality housing stock that is 60 years or older *(Ref:*

MOAttE09AgeofHousing.pdf); an unemployment rate three times the national average; the county's lowest levels of household wealth and highest concentrations of below-federal-level poverty; the county's highest concentrations of youth under 18; lack of insurance; location of several of the region's largest employers and potential for employment loss; location of the region's international airport; and a geographical racial divide in quality education and development investment that disproportionately negatively affects African Americans. Through this economic resilience framework and the concepts outlined in *Exhibit E (see page ExE-4)*, St. Louis County and the State of Missouri are dedicated to working with partners, especially municipal governments and nonprofit organizations (both inside and outside of the target area), to address unmet needs related to resiliency toward future disasters.

Housing

While affordable, the outdated, small, low-quality, housing stock from the 1950s in North St. Louis County presents an unmet need and a vulnerability to future disasters, especially tornadoes. *(Ref: MOExB12UnmetNeedHousSurvey.pdf).* One of our "known unknowns" is how robust North St. Louis County's housing market will be in upcoming decades. It is highly likely, however, that without redevelopment, this market will continue to hollow out. Thus, an important part of the economic resilience framework, described throughout this application, involves creating the conditions for new, mixed-income, mixed-use, transit-oriented housing markets in North St. Louis County. Ideally, the new markets will attract activity and investment to the area. They will also provide the opportunity for residents to become healthier and wealthier by being positioned near transit that leads to jobs and walkable neighborhood nodes that include social and economic services.

The community wants multi-family affordable housing that could be achieved through

redesign and redevelopment. The design pattern of 1950s-era neighborhoods created dense, large-scale blocks, which resulted in isolated neighborhoods with few nearby services. Modest additions of front porches, recreational open space, and places for youth, including childcare would benefit the neighborhood and create a sense of place. Reducing densely populated neighborhoods would assist with housing overcrowding and inadequate facilities.

Infrastructure

One vulnerability, and currently unmet need in a county of 90 municipalities, 49 of them located in the North St. Louis County target area, is the lack of free-flowing communication across jurisdictions. Most municipalities have their own emergency management systems. They interact to varying degrees with St. Louis County's Emergency Management department, power, gas, and water utilities, businesses, and humanitarian organizations after a disaster, depending on capabilities and infrastructure. Reporting is often redundant or nonexistent. It leaves gaps in service to residents that are difficult to quantify. This level of complexity only hinders resilience in the face of disaster.

Investing in a cross-jurisdictional regional resiliency collaboration that educates local governments on best practices and standards for emergency management and communication would address the community's ability to accelerate recovery. It would also help put the region's Disaster Mitigation Plan, currently under review by FEMA, into full effect.

In addition, creation of a network of Community Organizations Active in Disaster that assigns the gathering and warehousing of disaster relief supplies within neighborhood resource centers will ensure that neighborhoods are always equipped with emergency supplies independent of the condition of the post-disaster transportation network.

Economic Revitalization

North St. Louis County is home to several large employers such as Express Scripts, Boeing, and Emerson Electric. They are all located in campus-style office parks that are not accessible. The area is dotted with hundreds of small, locally owned businesses located along neighborhood and arterial strips. These small commercial strips are vulnerable to tornado damage, since small business owners are often not insured against natural disasters. *(Ref: MOExB18UnmetNeedEcon6DamagedBiz.pdf)*

The economic resiliency framework includes partnering with the public transit system to study the transit network. Necessary adjustments will provide better coverage between neighborhoods and jobs. Replicating small, neighborhood-serving resource centers around the target area will also improve residents' individual wealth and well-being by providing them access to life skills training, low-cost insurance and other financial counseling, space for entrepreneurial activities, and transit-connected access to job training programs.

Environmental Degradation

The open spaces of North St. Louis County do not contribute to area resilience. Parks and open spaces are largely impermeable and subject to flash flooding. Stream banks are steep, eroding, and filled with illegally dumped trash that contribute to neighborhood flooding. Trees lost in severe storms and tornadoes are never fully or strategically replaced. Neighborhoods and neighborhood streams are not appropriately buffered from brownfields, especially in the municipalities of Berkeley, Kinloch, Ferguson and Wellston.

Planning for and protecting open space around floodplains and buffers around stream banks, as well as building stormwater drainage environments (bioswales) into existing parks will assist North St. Louis County in flood prevention and private property protection. Likewise,

strategic tree selection and planting will help protect the area from conflicts with above-ground utilities, provide wind resistance, and protect the lifespan of the urban forest.

Currently, brownfields in North St. Louis County municipalities, especially Kinloch, Wellston, and Berkeley are in various stages of remediation, but not redevelopment. This impact is felt at the macro scale in terms of community disinvestment and as at the micro scale in family health and well-being. These impacts have been observed locally with the spread of contamination via the flooding of Coldwater Creek.

Missouri's brownfield remediation tax credit program redevelops contaminated property that has experienced deterioration, disinvestment and population and job loss. In addition to existing programs, design solutions help separate and protect neighborhoods from brownfields by integrating wide landscaped buffers into development projects. Adequate buffers reduce the visual and physical impacts of undeveloped brownfields, improve the recreational landscape, provide permeable surfaces, and add stream buffers that increase stormwater absorption.

Summary

St. Louis County is the largest economic engine for the state of the Missouri. The target area of North St. Louis County has the largest-and-growing concentration of socioeconomic distress. Because of the locational importance of this portion of the county to the state, and to work to reduce disparities in wealth and opportunity across races, it is imperative that the most distressed communities, which taken together represent about one-third of the county's total area, be a major focus of current and future resiliency planning.